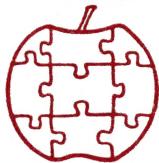


# Apple



# Assembly Line

\$1.50

Volume 3 -- Issue 8

May, 1983

### In This Issue...

Displaying Character Generator EPROMS. . . . .	2
S-C Word Processor Note. . . . .	10
Apple Chips. . . . .	12
S-C Capture. . . . .	13
A PAUSE Directive. . . . .	17
Some New Cards . . . . .	20
FADD -- Find ADDRESS References. . . . .	21
Generating Parity. . . . .	24
ROGRAM TOO LARGE???. . . . .	28

### Yet Another Cross Assembler: PDP-11

We are turning the tables at last. When the 6502 was created six or seven years ago, programmers used PDP-11 development systems with cross assemblers to write 6502 code. Now you can use your Apple to write programs for the Digital Equipment Corporation's -11 family. Thanks to Martin Buchholz for encouraging us to develop this one. He plans to use it for writing programs to run in DEC Falcon SBC-11 based systems. Only \$50, if you already own the S-C Macro Assembler. See our ad on page 16 for more about the Cross Assemblers.

### We Need Your Help

Does anybody have complete details of the file format of the Apple ///'s relocatable object files? That's the last remaining stumbling block on the road to the S-C Macro Assembler ///. Has anyone figured it out yet?

### All Around the World

We are now sending the Apple Assembly Line to subscribers in 32 different countries. (That's about 1200 copies to the USA, and about 100 copies to the other 31 nations.)

## Displaying Character Generator EPROMs.....Bob Sander-Cederlof

We make our own Character Generator EPROMs for Revision 7 or later Apple II Plusses. I use the Mountain Hardware EPROM Burner to burn the data into 2716 EPROMS. We have several different character sets, and it can be a lot of trouble to check the results.

After designing a character set, and formatting all the bits into the 2048 bytes of EPROM space, and burning it in, we still have to take an Apple apart and plug the chip in to see if all the characters look right.

I decided to write a program which would map the EPROM data onto the hi-res screen, allowing me to test without wasting time burning/erasing EPROMs and dismantling/re-assembling my Apple.

Even if you don't have the same requirements, you can learn a lot about indexing techniques and address shuffling from studying the following program.

Starting at the top.... I set up three page-zero variables in lines 1040-1060. The S-C Macro Assembler is a great environment for making short programs like this one, because I can cycle through edit-assemble-test until it works just right without ever leaving the assembler. S-C Macro allows me to use zero-page locations \$00-\$1F without fear of interference (\$00-\$1E in the Apple //e).

Lines 1080 and 1090 define two buffers where I BLOAD two different EPROM images. I put one at \$6800-6FFF, the other at \$7000-77FF. There is room on the screen to display one character set in a 16x16 matrix on the left side, and the other on the right side.

For grins, I decided to use the subroutine in Applesoft ROM at \$F3E2 to turn on hi-res mode. This is the code executed for the HGR statement, so I called it AS.HGR at line 1110. HGR sets all the soft-switches to hi-res page 1, and clears the screen.

Lines 1160-1180 call the HGR subroutine. Since I was using S-C Macro in the RAM card, and since the Applesoft ROMs are not switched on when a program is executing in the RAM card, I had a problem. The first time I tried to run DISPLAY, I left out lines 1160 and 1180. The result was a total disaster. Line 1170 did a JSR \$F3E2 into the RAM card! I had to RESET and reboot the computer to get control again. Look out for these kinds of problems whenever you are trying to use code in both places at once.

Lines 1190-1280 set up the starting addresses to display the first character set on the left half of the screen. Lines 1290-1380 do the same job to show the second set on the right half-screen.

S-C Macro Assembler (the best there is!).....	\$80.00
S-C Macro Assembler Version 1.1 Update.....	\$12.50
For registered owners of the S-C Macro Assembler.	
Source code of S-C Assembler II, Version 4.0, on disk.....	\$95.00
Fully commented, easy to understand and modify to your own tastes.	
S-C Macro Assembler /// .....	\$100.00
Preliminary version. Call or write for details.	
 S-C Cross Reference Utility .....	\$20.00
S-C Cross Reference Utility with Complete Source Code.....	\$50.00
 S-C Word Processor.....	\$50.00
As is, with fully commented source code. Needs S-C Macro Assembler.	
Applesoft Source Code on Disk.....	\$50.00
Very heavily commented. Requires Applesoft and S-C Assembler.	
ES-CAPE: Extended S-C Applesoft Program Editor.....	\$60.00
 AAL Quarterly Disks.....	each \$15.00
Each disk contains all the source code from three issues of "Apple Assembly Line", to save you lots of typing and testing time.	
QD#1: Oct-Dec 1980     QD#2: Jan-Mar 1981     QD#3: Apr-Jun 1981	
QD#4: Jul-Sep 1981     QD#5: Oct-Dec 1981     QD#6: Jan-Mar 1982	
QD#7: Apr-Jun 1982     QD#8: Jul-Sep 1982     QD#9: Oct-Dec 1982	
QD#10: Jan-Mar 1983	
 Double Precision Floating Point for Applesoft.....	\$50.00
Provides 21-digit precision for Applesoft programs.	
Includes sample Applesoft subroutines for standard math functions.	
 FLASH! Integer BASIC Compiler (Laumer Research).....	\$79.00
Source Code for FLASH! Runtime Package.....	\$39.00
Full Screen Editor for S-C Macro Assembler (Laumer Research).....	\$49.00
 The Visible Computer: 6502 (Software Masters).....(reg. \$50.00)	\$45.00
Super Disk Copy III (Sensible Software).....(reg. \$30.00)	\$27.00
Amper-Magic (Anthro-Digital).....(reg. \$75.00)	\$67.50
Amper-Magic Volume 2 (Anthro-Digital).....(reg. \$35.00)	\$30.00
Quick-Trace (Anthro-Digital).....(reg. \$50.00)	\$45.00
DISASM Dis-Assembler (Rak-Ware).....	\$30.00
 Blank Diskettes (with hub rings).....package of 20 for \$50.00	
Small 3-ring binder with 10 vinyl disk pages and disks.....	\$36.00
Vinyl disk pages, 6"x8.5", hold one disk each.....10 for \$6.00	
Reload your own NEC PC-8023 ribbon cartridges.....each ribbon	\$5.00
Reload your own NEC Spinwriter Multi-Strike Film cartridges.....each	\$2.50
Diskette Mailing Protectors.....10-99: 40 cents each	
100 or more: 25 cents each	
ZIF Game Socket Extender.....	\$20.00
Ashby Shift-Key Mod.....	\$15.00
Lower-Case Display Encoder ROM.....	\$25.00
Only Revision level 7 or later Apples.	
 Grappler+ Printer Interface (Orange Micro).....(\$175.00)	\$150.00
Bufferboard 16K Buffer for Grappler (Orange Micro).....(\$175.00)	\$150.00
Buffered Grappler+ NEW!! Interface and 16K Buffer.....(\$239.00)	\$200.00
 Books, Books, Books.....compare our discount prices!	
"The Apple II Circuit Description", Gayler.....(\$22.95)	\$21.00
"Enhancing Your Apple II, vol. 1", Lancaster.....(\$15.95)	\$15.00
"Incredible Secret Money Machine", Lancaster.....(\$7.95)	\$7.50
"Micro Cookbook, vol. 1", Lancaster.....(\$15.95)	\$15.00
"Beneath Apple DOS", Worth & Lechner.....(\$19.95)	\$18.00
"Bag of Tricks", Worth & Lechner, with diskette.....(\$39.95)	\$36.00
"Apple Graphics & Arcade Game Design", Stanton.....(\$19.95)	\$18.00
"Assembly Lines: The Book", Roger Wagner.....(\$19.95)	\$18.00
"What's Where in the Apple", Second Edition.....(\$24.95)	\$23.00
"What's Where Guide" (updates first edition).....(\$9.95)	\$9.00
"6502 Assembly Language Programming", Leventhal.....(\$16.99)	\$16.00
"6502 Subroutines", Leventhal.....(\$12.99)	\$12.00
 Add \$1 per book for US postage. Foreign orders add postage needed.	
 *** S-C SOFTWARE, P. O. BOX 280300, Dallas, TX 75228 ***	
*** (214) 324-2050 ***	
*** We take Master Charge, VISA and American Express ***	

\*\*\* S-C SOFTWARE, P. O. BOX 280300, Dallas, TX 75228 \*\*\*  
\*\*\* (214) 324-2050 \*\*\*  
\*\*\* We take Master Charge, VISA and American Express \*\*\*

The top line of hi-res page 1 starts at \$2000, and goes to \$2027. The middle of the line starts at \$2014. The starting addresses of subsequent lines can be computed from these two base addresses, although it is a little tricky. More on this later.

The hi-res screen shows the least significant seven bits from each byte. There are forty bytes in each line, making a total of 280 dots across. The dots in each byte are in reverse order: the least significant bit is the leftmost dot. On the other hand, the EPROM image is in normal order. The subroutine DISPLAY.ONE.SET takes care of all the addressing, and REVERSE.BITS handles the reversals.

Lines 1400-1410 pause until I hit any key on the keyboard. During this pause I can examine the screen as long as I wish. When I type any key, the keyboard strobe will be set and \$C000 will go negative. Line 1420 will then clear the keyboard strobe, and the RTS at line 1430 returns to the S-C Macro Assembler.

This brings us to a closer examination of the subroutine to actually display a character set, in lines 1440-1770. We will be displaying 16 rows of characters, with 16 characters in each row. It is therefore natural to simplify the problem by writing another subroutine to display one row of characters, and call it sixteen times.

Lines 1480 and 1490 start a loop much like Applesoft's FOR I = 1 TO 16...except in assembly language it is easier to go from 16 to 1. The equivalent to NEXT I is at lines 1750 and 1760, where CNT16 is decremented. In between we have the body of the loop.

Line 1500 calls DISPLAY.ONE.ROW, a subroutine that only gets called from this one line. I made it into a separate subroutine so I could put off writing it until later, and concentrate on one loop at a time. DISPLAY.ONE.ROW expects the addresses at SCREEN.ADR and EPROM.ADR to be already set up for the first byte to be displayed in the current row. After it returns, those addresses will have been modified.

Lines 1510-1580 add 15\*8, or 120, to the address in EPROM.ADR. DISPLAY.ONE.ROW already added 8, so the total augment is 128. This moves us up to the beginning of the next set of sixteen characters.

Lines 1590-1740 assume that DISPLAY.ONE.ROW already added \$2000 to the address in SCREEN.ADR, and subtracts that value back out. At the same time, we add back in \$80, to move to the next group of eight screen lines for the next row of characters. This is sufficient for the first eight rows of characters, but in moving to the ninth row there is a discontinuity which requires adding \$28 and subtracting \$400 to get the right address. The fact that the ninth row has arrived is apparent by the fact that the high byte of the address goes above \$23 (lines 1670 and 1680).

# RENT SOFTWARE BEFORE YOU BUY!

from our

## SOFTWARE RENTAL LIBRARY

You can now RENT the most popular software available for just

20-25%\* of Manufacturers' Retail Price

- Eliminate the risk—rent first!
- 100% of rental fee applies toward purchase
- All purchases are 20% Off of Manufacturer's Suggested List
- Rentals are for 7-days (plus 3 days grace for return shipping)
- No Membership Fees

Now currently available for:

Apple

IBM, PC

Standard CP/M

Eagle

TRS-80 II

Xerox 820

Northstar

Osborne

Heath/Zenith 89

Franklin

**REMEMBER, THESE ARE NOT DEMOS, BUT ORIGINAL  
UNRESTRICTED SOFTWARE PROGRAMS**

(complete with manuals in original manufacturers' packages)

To Immediately Order, or for more information:

**UNITED COMPUTER CORP.**

Software Rental Library

Culver City, California

Toll Free CALL 1-800 992-7777

In California, CALL 1-800 992-8888

In L.A. County CALL 1-213 823-4400



\*Plus postage and handling

FROGGER  CHOPLIFTER  GORF  DAVID'S MIDNIGHT MAGIC  EASTERN FRONT (1941)  ZORK I

Here is a table of the starting addresses for each of the 24 character rows (we only use the first 16):

Row	Address	Row	Address	Row	Address
1	\$2000	9	\$2028	17	\$2050
2	\$2080	10	\$20A8	18	\$20D0
3	\$2100	11	\$2128	19	\$2150
4	\$2180	12	\$21A8	20	\$21D0
5	\$2200	13	\$2228	21	\$2250
6	\$2280	14	\$22A8	22	\$22D0
7	\$2300	15	\$2328	23	\$2350
8	\$2380	16	\$23A8	24	\$23D0

The starting addresses for the right half-screen can be obtained by just adding \$14 to all of the above addresses. What we do is START at \$2014, and all the rest are computed automatically.

Now we can talk about what goes on inside one row of characters. Lines 1810-2000 do the job of moving bytes from the EPROM image to the eight screen lines which form the row of characters. Lines 1820-1830 start a loop to count out eight repetitions, and lines 1980-1990 perform the NEXT on this loop.

On each pass through the loop the subroutine GET.PUT is called sixteen times to move a byte for each character to the screen image. GET.PUT is another subroutine only called from one place, but made into a subroutine for ease of understanding. The inner loop of 0 through 15 is controlled by the X-register. Line 1850 sets X=0, and lines 1910-1930 increment, test, and branch ("NEXT X" sequence). The X-register also indexes the STA instruction inside GET.PUT, so that the screen byte for each character is stored into the right place on the screen line. The Y-register is used as an index into the EPROM data by GET.PUT, and parallels the X-register but with an increment of 8 rather than 1. Lines 1870-1900 bump the Y-register by 8 each time through the inner loop.

GET.PUT (lines 2230-2340) does the very simple job of moving one byte from one place in memory to another. Or is it so simple.... Notice that the addresses inside the LDA and STA instructions are filled in when the program runs. This is called self-modifying code, and I normally avoid such code at all costs. It can lead to all sorts of devastating things. Nevertheless, there are exceptions to most rules, and a time for nearly everything. This is one of those, I think. Isolating the offensive code into its own little subroutine appeases my conscience somewhat.

In between LDA and STA I call REVERSE.BITS, yet another simple subroutine which could be written in-line. I prefer making it separate for nicer modularity. The comments show what is going on, bit-by-bit. If you were working from character generator data written for the DOS TOOL KIT or HIGHER TEXT, the bits would already be in the right order. It is just because I am using data for the character generator EPROM that we need to reverse the bits.

Here is a printout done with my NEC PC-8023 and a Grappler+ interface card. The two character sets shown are the ones we sell. The one on the left uses regular lower case characters, with descenders. All the lower case characters are raised up one screen line to leave room for the descenders. The set on the right uses small caps for the lower case, and is the one we use in all the Apples here. The first four rows are the characters used in INVERSE mode, and the next four rows are for FLASH mode. (Doesn't flash too well on paper!)

```

@ABCDEFGHIJKLMNO
PQRSTUUVWXYZE^J^_
!"#$%&'(')*+,,-/_/
0123456789:,;<=>?
@ABCDEFGHIJKLMNO
PQRSTUUVWXYZE^J^_
!"#$%&'(')*+,,-/_/
0123456789:,;<=>?
@ABCDEFGHIJKLMNO
PQRSTUUVWXYZE^J^_
!"#$%&'(')*+,,-/_/
0123456789:,;<=>?
@ABCDEFGHIJKLMNO
PQRSTUUVWXYZE^J^_
`abcde fghi jklmno
pqrstuvwxyz{!}~#

```

```

@ABCDEFGHIJKLMNO
PQRSTUUVWXYZE^J^_
!"#$%&'(')*+,,-/_/
0123456789:,;<=>?
@ABCDEFGHIJKLMNO
PQRSTUUVWXYZE^J^_
!"#$%&'(')*+,,-/_/
0123456789:,;<=>?
@ABCDEFGHIJKLMNO
PQRSTUUVWXYZE^J^_
!"#$%&'(')*+,,-/_/
0123456789:,;<=>?
@ABCDEFGHIJKLMNO
PQRSTUUVWXYZE^J^_
`ABCDEF GHIJKLMNO
PQRSTUUVWXYZ{!}~#

```

*It's here at last*

# PRAWM

(8K byte non-volatile memory for Apple II<sub>1</sub>)

- Write like a RAM
- Data retention like a ROM
- No battery backup required
- Off the shelf delivery
- 1 year limited warranty
- Enable/disable under program control without (FFFF)
- Data alterable 1 byte at a time
- No EPROM programmer necessary
- No ultraviolet lights to erase
- Auto start on power-up
- Operates in any "Apple II<sub>1</sub>" peripheral slot
- On board firmware for block transfers
- Permanent storage of new commands, subroutines, utilities.
- Multiple configurations: 2K, 4K, 6K, 8K bytes
- User-expandable to 8K bytes
- Compatible with Apple II + and Apple IIe

1 Apple II is a registered trademark  
of Apple Computer, Cupertino, CA

To order call 503-654-0611 or fill out order form:

Please send me a PRAWM board  
in the following configuration:

Configuration	Qty	Unit Price	Total
2K bytes	_____	124.95	_____
4K bytes	_____	166.95	_____
6K bytes	_____	208.95	_____
8K bytes	_____	249.95	_____

Include \$2.00/board shipping &  
handling

Amount enclosed \_\_\_\_\_

SHIP TO: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Please send: cert. check  
money order  
personal check  
VISA or MasterCard  
accepted

To: Advanced Peripheral Ent., Inc.  
2617 S.E. Swain Ave.  
Milwaukie, OR 97222

SHIP VIA: \_\_\_\_\_

COD orders accepted

FASTDRAW 1.1

A software package from CASTLE DESIGNS which provides enhanced Hi-Resolution Graphics instructions for use in Applesoft Basic programs. For example ....

<b>&amp;DRAW,1</b>	Erases, moves and re-draws an entire array of shapes with a single instruction.
<b>&amp;HPOINT,1</b>	Erases, moves and replots an array of points.
<b>&amp;HGR,c</b>	Performs a hi-speed screen erase to any color.

Plotting rate exceeds 4,000 points per second.

Other FASTDRAW 1.1 instructions provide scrolling, as well as drawing or plotting without erasing. Assembly language entry points are also provided. These new commands may be used to create fast-moving Basic games or to plot data quickly.

This software may be used with the APPLIED ENGINEERING A/D BOARD to acquire and plot analog data. The A/D BOARD will acquire 8 channels of data with 8-bit resolution, and is very easy to use. Simply use a PEEK statement to read the data.

**APPLIED ENGINEERING A/D BOARD** \$129.00

To acquire data with real-time accuracy, use the APPLIED ENGINEERING TIMEMASTER real time clock board in combination with the A/D BOARD and the FASTDRAW 1.1 software. The TIMEMASTER will provide timing for data acquisition as often as once per millisecond. For example, 200 data points can be acquired and plotted in 250 milliseconds.

APPLIED ENGINEERING TIMEMASTER \$129.00

Included on the FASTDRAW 1.1 diskette are several programs which demonstrate its various uses and a utility which merges two shape tables. Special routines in both Basic and assembly language are provided which utilize the APPLIED ENGINEERING boards to acquire and plot data. Manual included. Requires Applesoft and DOS 3.3, and an APPLE II, II+, or IIe w/48K Ram.

**CASTLE DESIGNS FASTDRAW 1.1 ..... \$29.95**

**Texas Residents Add 5% Sales Tax (Hardware Only).**  
**Add \$10.00 If Outside U.S.A.**

Order any of the above items from APPLIED ENGINEERING, P.O. BOX 470301, DALLAS, TEXAS 75247 : Phone (214) 492-2027

Or order FASTDRAW 1.1 from CASTLE DESIGNS, 2717 TEAKWOOD,  
PLANO, TEXAS 75075

FASTDRAW 1.1

```

1010 *-----  

1020 *----- DISPLAY CHARACTER SET  

1030 *-----  

0000- 1040 CNT8 :EQ $00  

0001- 1050 B :EQ $01  

0002- 1060 CNT 16 :EQ $02  

1070 *-----  

6800- 1080 EPROM.A.IMAGE .EQ $6800  

7000- 1090 EPROM.B.IMAGE .EQ $7000  

1100 *-----  

F3E2- 1110 AS.HGR .EQ $F3E2  

1120 *-----  

1130 .OR $803  

1140 DISPLAY *----TURN ON HI-RES GRAPHICS----  

0803- AD 81 CO 1150 LDA $C081 GET A/S ROMS ON MOTHERBOARD  

0806- 20 E2 F3 1160 JSR AS.HGR  

0809- AD 80 CO 1170 LDA $C080 BACK TO S-C ASM IN RAM CARD  

1180 *----FIRST CHAR SET----  

080C- A9 20 1200 LDA /$2000 TOP LINE, LEFT SIDE  

080E- 8D CC 08 1210 STA SCREEN.ADR+1  

0811- A9 00 1220 LDA #$2000  

0813- 8D CB 08 1230 STA SCREEN.ADR  

0816- A9 68 1240 LDA /EPROM.A.IMAGE FIRST CHARACTER SET  

0818- 8D C6 08 1250 STA EPROM.ADR+1  

081B- A9 00 1260 LDA #EPROM.A.IMAGE  

081D- 8D C5 08 1270 STA EPROM.ADR  

0820- 20 43 08 1280 JSR DISPLAY.ONE.SET  

1290 *----SECOND CHAR SET----  

0823- A9 20 1300 LDA /$2014 TOP LINE, RIGHT SIDE  

0825- 8D CC 08 1310 STA SCREEN.ADR+1  

0828- A9 14 1320 LDA #$2014  

082A- 8D CB 08 1330 STA SCREEN.ADR  

082D- A9 70 1340 LDA /EPROM.B.IMAGE SECOND CHARACTER SET  

082F- 8D C6 08 1350 STA EPROM.ADR+1  

0832- A9 00 1360 LDA #EPROM.B.IMAGE  

0834- 8D C5 08 1370 STA EPROM.ADR  

0837- 20 43 08 1380 JSR DISPLAY.ONE.SET  

1390 *----PAUSE UNTIL KEYSTROKE----  

083A- AD 00 CO 1400 .1 LDA $C000  

083D- 10 FB 1410 BPL .1  

083F- 8D 10 CO 1420 STA $C010  

0842- 60 1430 RTS RETURN TO ASSEMBLER  

1440 *-----  

1450 *----- DISPLAY ONE CHARACTER SET IN 16-BY-16  

1460 *----- FORMAT  

1470 DISPLAY.ONE.SET  

0843- A9 10 1480 LDA #16 COUNT 16 ROWS  

0845- 85 02 1490 STA CNT16  

0847- 20 85 08 1500 :1 JSR DISPLAY.ONE.ROW  

1510 *----NEXT ROW IN EPROM DATA----  

084A- 18 1520 CLC  

084B- AD C5 08 1530 LDA EPROM.ADR  

084E- 69 78 1540 ADC #15*8  

0850- 8D C5 08 1550 STA EPROM.ADR  

0853- AD C6 08 1560 LDA EPROM.ADR+1  

0856- 69 00 1570 ADC #0  

0858- 8D C6 08 1580 STA EPROM.ADR+1  

1590 *----NEXT ROW ON SCREEN----  

085B- 38 1600 SEC  

085C- AD CB 08 1610 LDA SCREEN.ADR  

085F- E9 80 1620 SBC #$2000-$80  

0861- 8D CB 08 1630 STA SCREEN.ADR  

0864- AD CC 08 1640 LDA SCREEN.ADR+1  

0867- E9 1F 1650 SBC /$2000-$80  

0869- 8D CC 08 1660 STA SCREEN.ADR+1  

086C- C9 24 1670 CMP #24 HIT THE BREAK YET?  

086E- 90 10 1680 BCC .2 NO GO ON  

0870- AD CB 08 1690 LDA SCREEN.ADR YES, ADJUST THE  

0873- E9 D8 1700 SBC #$400-$28 ADDRESSES  

0875- 8D CB 08 1710 STA SCREEN.ADR  

0878- AD CC 08 1720 LDA SCREEN.ADR+1  

087B- E9 03 1730 SBC /$400-$28  

087D- 8D CC 08 1740 STA SCREEN.ADR+1  

0880- C6 02 1750 .2 DEC CNT16 LAST ROW YET?  

0882- D0 C3 1760 BNE .1 ...NO  

0884- 60 1770 RTS ...YES, RETURN

```

```

1780 *-----*
1790 *----- DISPLAY ONE ROW OF 16 CHARACTERS
1800 *-----*
1810 DISPLAY.ONE.ROW
0885- A9 08 1820 LDA #8      8 SCREEN LINES FOR ONE ROW
0887- 85 00 1830 STA CNT8
0889- A0 00 1840 .1 LDY #0      EPROM DATA INDEX
088B- A2 00 1850 LDX #0      SCREEN IMAGE INDEX
088D- 20 C4 08 1860 .2 JSR GET.PUT MOVE ONE BYTE TO SCREEN
0890- 98 1870 TYA ADD 8 TO EPROM DATA INDEX
0891- 18 1880 CLC
0892- 69 08 1890 ADC #8
0894- A8 1900 TAY
0895- E8 1910 INX      BUMP SCREEN IMAGE INDEX
0896- E0 10 1920 CPX #16
0898- 90 F3 1930 BCC .2      MORE CHARACTERS
089A- EE C5 08 1940 INC EPROM.ADR BUMP TO NEXT LINE OF EPROM
089D- AD CC 08 1950 LDA SCREEN.ADR+1 +$400
08A0- 69 03 1960 ADC #3      (CARRY = 1)      DATA
08A2- 8D CC 08 1970 STA SCREEN.ADR+1
08A5- C6 00 1980 DEC CNT8      NEXT SCREEN LINE
08A7- D0 E0 1990 BNE .1      ..IF ANY
08A9- 60 2000 RTS      RETURN
2010 *-----*
2020 *----- REVERSE THE ORDER OF BITS 6-0 IN A-REG
2030 *----- (CHANGE XABCDEFG TO OGFEDCBA)
2040 *-----*
2050 REVERSE.BITS
08AA- 4A 2060 LSR      REVERSE 7 BITS
08AB- 26 01 2070 ROL B    A=0XABCDEF B=XXXXXXG
08AD- 4A 2080 LSR      A=00XABCDE B=XXXXXXGF
08AE- 26 01 2090 ROL B    A=000XABCD B=XXXXXXGFE
08B0- 4A 2100 LSR      A=0000XABC B=XXXXGFED
08B1- 26 01 2110 ROL B    A=00000XAB B=XXXGFEDC
08B3- 4A 2120 LSR      A=000000XA B=XXGFEDCB
08B4- 26 01 2130 ROL B    A=0000000X B=XGFEDCBA
08B6- 4A 2140 LSR      A=00000000
08B7- 26 01 2150 ROL B
08B9- 4A 2160 LSR
08BA- 26 01 2170 ROL B
08BC- 4A 2180 LSR
08BD- 26 01 2190 ROL B
08BF- A5 01 2200 LDA B
08C1- 29 7F 2210 AND #$7F
08C3- 60 2220 OGFEDCBA
RTS
2230 *-----*
2240 *----- PICK UP A BYTE OF EPROM DATA,
2250 *----- REVERSE THE BITS, AND STORE
2260 *----- IT ON THE SCREEN.
2270 *-----*
2280 GET.PUT
08C4- B9 FF FF 2290 LDA $FFFF,Y
08C5- 2300 EPROM.ADR.EQ #-2
08C7- 20 AA 08 2310 JSR REVERSE.BITS
08CA- 9D FF FF 2320 STA $FFFF,X
08CB- 2330 SCREEN.ADR.EQ #-2
08CD- 60 2340 RTS

```

### S-C Word Processor note.....Mike Laumer

We recently had one customer give us a great compliment on the S-C Word Processor. He has given up on WORDSTAR! He found that the S-C Word Processor can read and write large text files 20 times faster than WORDSTAR and that scrolling was much quicker. He can be in and out of the S-C Word Processor before WORDSTAR even lets him type a single key. The S-C Word Processor is also much less expensive than WORDSTAR and you don't have to buy a Z-80 card!

His only desire was to have an 80 column version of the Word Processor. However, that wouldn't be nearly so fast since SCWP re-writes the screen on every keystroke. I have noticed also that the 40 column display never causes me eye strain, but all the 80 column displays do.

# **QUICKTRACE**

relocatable program traces and displays the actual machine operations, while it is running without interfering with those operations. Look at these FEATURES:

**Single-Step mode displays the last instruction, next instruction, registers, flags, stack contents, and six user-definable memory locations.**

**Trace mode gives a running display of the Single-Step information and can be made to stop upon encountering any of nine user-definable conditions.**

**Background mode permits tracing with no display until it is desired. Debugged routines run at near normal speed until one of the stopping conditions is met, which causes the program to return to Single-Step.**

**QUICKTRACE allows changes to the stack, registers, stopping conditions, addresses to be displayed, and output destinations for all this information. All this can be done in Single-Step mode while running.**

**Two optional display formats can show a sequence of operations at once. Usually, the information is given in four lines at the bottom of the screen.**

**QUICKTRACE is completely transparent to the program being traced. It will not interfere with the stack, program, or I/O.**

**QUICKTRACE is relocatable to any free part of memory. Its output can be sent to any slot or to the screen.**

**QUICKTRACE is completely compatible with programs using Applesoft and Integer BASICs, graphics, and DOS. (Time dependent DOS operations can be bypassed.) It will display the graphics on the screen while QUICKTRACE is alive.**

**QUICKTRACE is a beautiful way to show the incredibly complex sequence of operations that a computer goes through in executing a program**

**QUICKTRACE**

\$50

Is a trademark of Anthro-Digital, Inc.

Copyright © 1981

Written by John Rogers

See these programs at participating Computerland and other  
fine computer stores.

**Anthro - Digital Software, Inc.**  
**P.O. Box 1385 Pittsfield, MA 01202**

**Apple Chips.....Bob and Bill**

You may recall that when Bill reviewed Apple ][ Circuit Description last month, he bemoaned the lack of a "Cross Reference", by board location, of all the Apple's ICs. Well Bob has worked out a couple of tables to fill that gap, and we'll be including those tables in future shipments of the book.

In the meantime, here's another sort of table, showing the locations and descriptions of all the chips in your Apple. This one is organized by chip number.

Chip	Board Location(s)	Chip Description
555	A13 B3	Timer
558	H13	3 Timers
741	K13	Op Amp
2316B	A5 (Rev 7,RFI)	ROM (character generator)
2513	A5 (Rev 0,1)	ROM (character generator)
4116	C3-10 D3-10 E3-10	RAM
6502	H6-9	Microprocessor
9316B	F3-11 (6 chips)	ROM (monitor and language)
74LS00	A2	4 2-input NAND
74LS02	A12 A14 B13 B14	4 2-input NOR
74LS04	C11	6 Inverters
74LS08	B11 H1	4 2-input AND
74LS11	B12	3 3-input AND
74LS20	D2	2 4-input NAND
74LS32	C14	4 2-input OR
74LS51	C13	AND3-NOR2, AND2-NOR2
74LS74	A11 B10 J13	2 Flip-Flops
74LS86	B2	4 2-input XOR
74LS138	F12 F13 H2 H12	3-by-8 Decoder
74LS139	E2 F2	2 3-by-4 Decoders
74LS151	A9	1-of-8 Selector
74LS153	C1 E11 E12 E13	2 1-of-4 selectors
74LS161	D11-14	Counter
74166	A3	8-bit Shift Register
74LS174	B5 B8	6 Flip-Flops
74LS175	B1	4 Flip-Flops
74LS194	A10 B4 B9	4-bit Shift Register
74LS195	C2	4-bit Shift Register
74LS251	H14	1-of-8 Selector
74LS257	A8 B7 C12 J1	4 1-of-2 Selectors
74LS259	F14	8-bit Addressable Latch
74LS283	E14	4-bit Full Adder
74LS367	H3 H4 H5 (on some models)	6 Bus Drivers
8T97	H3 H4 H5 (on most models)	6 Bus Drivers
8T28	H10 H11 (on rev 0,1,7)	4 Bus Buffers
8304	H10 (on ref RFI)	8 Bus Buffers

S-C CAPTURE -- A Modem Program for the Word Processor.....  
Jim Church

If you like to sign on to the The Source or CompuServe or some such system, you should get a copy of the S-C Word Processor. I like to receive the programs from CALL-A.P.P.L.E. magazine by modem and the S-C Word Processor really makes that easy.

What you do is quite simple. Just put a copy of B.SC.CAPTURE on the disk with the Word Processor. Then, whenever you want to capture a session with a remote system, you can choose D from the word processor menu and BLOAD B.SC.CAPTURE. After the routine is loaded, return to the main menu and choose L to load a sign-on file containing the commands necessary to dial the number you want to call. Here is a sample sign-on file, which I use to call up The Source.

```
!pr2  
Q*367-6021      (The Q is a Control-Q)  
!pr768
```

Now choose P from the menu, and your word processor will start dialing the phone! From here on you just operate the remote system as usual. The top line of the screen will show the address where characters are being stored, and the rest of the screen shows the text you are entering and receiving.

When you want to quit, just type a Control Z to hang up your phone and return to the word processor's main menu. Select E and you will see a copy of everything that transpired. Now you can edit the text however you want to, and save it all to your disk.

The !pr768 command above is intended to provide a hook for a user-written printer driver. It sets the output hook at \$36-37 to \$300. The next time the Word Processor tries to output a character, it wakes up the capture routine, which completely takes over until it is turned off with a Control Z. This is slightly abusing the !pr directive, so if you follow this example for other routines, be sure to have lines like 1570-1590 at the beginning of your routine, and exit to \$803 at the end, so the Word Processor can reconnect itself correctly.

That's all there is to it. You could probably do a lot to "smarten up" this dumb terminal program. The way I have done it, it recognizes a Control Z from the keyboard and filters out incoming Control J's. That's all it does. Probably it should filter out Control G too, at the very least. My intention is to demonstrate the simple fact that the word processor is a very versatile creature.

This works, the way it is, with the D. C. Hayes Micromodem II in Slot 2. If your modem is in a different slot, just change line 1260 to show the correct slot number.

```

1000 *-----*
1010 *
1020 * S-C CAPTURE
1030 *
1040 * A COMMUNICATIONS MODULE FOR
1050 * THE S-C WORD PROCESSOR
1060 *
1070 * BY JIM CHURCH
1080 *
1090 *-----*
1100 * FULL DUPLEX CAPTURE PROGRAM
1110 * WORKS WITH MICROMODEM II
1120 * AND S-C WORD PROCESSOR
1130 *
1140 * GO INTO EDITOR W/EMPTY BUFFER
1150 * ENTER COMMANDS AS FOLLOW:
1160 *
1170 * lpr2
1180 * Q*367-6021 THE "Q" IS A CONTROL-Q
1190 * lpr768
1200 *
1210 * LEAVE EDITOR, CHOOSE P ON MENU
1220 *
1230 * OR $300
1240 * .TF B.SC.CAPTURE
1250 *
0002- 1260 SLOT .EQ $02
0020- 1270 SLOT16 .EQ SLOT*16
1280 *
0000- 1290 PTR .EQ $00
0022- 1300 WNDTOP .EQ $22
0024- 1310 CH .EQ $24
1320 *
03EA- 1330 HOOK .EQ $3EA
1340 *
2000- 1350 BUFFER .EQ $2000
1360 *
C000- 1370 KEYBOARD .EQ $C000
C010- 1380 STROBE .EQ $C010
C0A5- 1390 MM.CR2 .EQ $C085+SLOT16
C0A6- 1400 MM.STATUS .EQ $C086+SLOT16
C0A7- 1410 MM.DATA .EQ $C087+SLOT16
1420 *
F941- 1430 PRNTAX .EQ $F941
FB2F- 1440 INIT .EQ $FB2F
FC22- 1450 VTAB .EQ $FC22
FC24- 1460 VTABZ .EQ $FC24
FC58- 1470 HOME .EQ $FC58
FDF0- 1480 COUT1 .EQ $FDF0
FE89- 1490 SETKBD .EQ $FE89
FE93- 1500 SETVID .EQ $FE93
1510 *
1520 *-----*
SC.CAPTURE
0300- 20 2F FB 1530 JSR INIT FIX SCREEN
0303- 20 58 FC 1540 JSR HOME CLEAR SCREEN
0306- A9 01 1550 LDA #1 RESERVE TOP LINE
0308- 85 22 1560 STA WNDTOP FOR LOCATION COUNTER
030A- 20 93 FE 1570 JSR SETVID PR#0
030D- 20 89 FE 1580 JSR SETKBD IN#0
0310- 20 EA 03 1590 JSR HOOK TELL DOS
0313- A2 00 1600 LDX #0 WORD PROCESSOR
0315- 8E 00 20 1610 STX BUFFER NEEDS 0 AT $2000
0318- E8 00 1620 INX
0319- 86 00 1630 STX PTR START POINTER
031B- A9 20 1640 LDA /BUFFER AT $2001
031D- 85 01 1650 STA PTR+1
1660 *
TERMINAL
031F- AD 00 CO 1680 LDA KEYBOARD KEY DOWN?
0322- 10 15 1690 BPL MODEM NO, CHECK MODEM
0324- 8D 10 CO 1700 STA STROBE YES, CLEAR STROBE
0327- C9 9A 1710 CMP #$9A CONTROL Z?
0329- F0 4C 1720 BEQ QUIT YES, LEAVE
032B- 48 1730 PHA SAVE KEYPRESS
032C- AD A6 CO 1740 .1 LDA MM.STATUS CHECK IF THE TRANSMIT
032F- 29 02 1750 AND #$02 REGISTER EMPTY BIT IS SET
0331- F0 F9 1760 BEQ .1 NO, WAIT FOR IT
0333- 68 1770 PLA YES, GET KEY BACK
0334- 8D A7 CO 1780 STA MM.DATA SEND IT
0337- 30 E6 1790 BMI TERMINAL AND LOOP AGAIN
1800

```

0339-	AD	A6	CO	1810	MODEM	LDA MM.STATUS	CHECK IF THE RECEIVER AND #\$01 REGISTER FULL BIT IS SET
033C-	29	01		1820		BEQ TERMINAL	NO LOOP AGAIN
033E-	F0	DF		1830		LDA MM.DATA	YES, GET CHARACTER
0340-	AD	A7	CO	1840		ORA #\$80	SET HI BIT
0343-	09	80		1850		CMP #\$8A	CONTROL J?
0345-	C9	8A		1860		BEQ TERMINAL	IGNORE IT
0347-	F0	D6		1870		JSR COUT1	PRINT CHAR
0349-	20	FD		1880		LDY #0	
034C-	A0	00		1890		STA (PTR),Y	CAPTURE IT IN BUFFER
034E-	91	00		1900			
				1910			
0350-	E6	00		1920	INCR	INC PTR	BUMP POINTER LO
0352-	D0	08		1930		BNE COUNT	NOT 0
0354-	E6	01		1940		INC PTR+1	BUMP POINTER HI
0356-	A5	01		1950		LDA PTR+1	CHECK IF
0358-	C9	96		1960		CMP #\$96	BUFFER END?
035A-	B0	1B		1970		BCS QUIT	FULL BUFFER, LEAVE
				1980			
035C-	A5	24		1990	COUNT	LDA CH	SAVE CH
035E-	48			2000		PHA	ON STACK
035F-	A9	00		2010		LDA #0	TOP LINE
0361-	20	24	FC	2020		JSR VTABZ	FOR LOCATION COUNTER
0364-	A9	14		2030		LDA #\$14	COL 20
0366-	85	24		2040		STA CH	IN CH
0368-	A5	01		2050		LDA PTR+1	HI BYTE OF LOCATION
036A-	A6	00		2060		LDX PTR	LO BYTE
036C-	20	41	F9	2070		JSR PRNTAX	PRINT ADDRESS
036F-	68			2080		PLA	GET OLD CH AND RETURN
0370-	85	24		2090		STA CH	TO WHERE WE WERE
0372-	20	22	FC	2100		JSR VTAB	OLD LINE
0375-	90	A8		2110		BCC TERMINAL	START OVER
				2120			
0377-	A9	00		2130	QUIT	LDA #\$00	END-OF-TEXT MARKER
0379-	91	00		2140		STA (PTR),Y	FOR WORD PROCESSOR
037B-	A9	05		2150		LDA #\$05	HANG UP PHONE
037D-	8D	A5	CO	2160		STA MM.CR2	AT CONTROL REGISTER
0380-	4C	03	08	2170		JMP \$803	COLDSTART WORD PROCESSOR

**N E W from Laumer Research**  
**The S-C Macro Assembler Screen Editor.**

Powerful Screen Editor for assembler files, co-resident with the S-C Macro Assembler allowing screen editing when you want it and S-C Macro Assembler editing too. Loads in the unused 4K bank of memory in a 16K Language Card.

Includes SYSGEN program for configuring standard 40 column Apple, 80 column VIDEX, or 80 column STB80 video drivers. Adjustable tabs, margins, horizontal and vertical scrolling, lines to 248 columns, and much more...

SOURCE code included. (Lets you learn about screen editors and configure for other brands of 80 column boards)

Based on a popular TI 990 editor for software developers.  
NOTE: this is not a word processor editor. Organized just for computer languages. If you work with assembly programs of 100 lines or more, then a Screen Editor is a MUST!

Requires 64K APPLE II with Language card and S-C Macro Assembler Language Card Version 1.0.

Price \$49.00 from LAUMER RESEARCH  
1832 SCHOOL RD.  
CARROLLTON, TX 75006

Master Card and Visa accepted (send Name, card number and exp. date). Foreign orders add \$3.00 shipping (US funds only).

## S-C Macro Cross Assemblers

The high cost of dedicated microprocessor development systems has forced many technical people to look for alternate methods to develop programs for the various popular microprocessors. Combining the versatile Apple II with the S-C Macro Assembler provides a cost effective and powerful development system. Hobbyists and engineers alike will find the friendly combination the easiest and best way to extend their skills to other microprocessors.

The S-C Macro Cross Assemblers are all identical in operation to the S-C Macro Assembler; only the language assembled is different. They are sold as upgrade packages to the S-C Macro Assembler. The S-C Macro Assembler, complete with 100-page reference manual, costs \$80; once you have it, you may add as many Cross Assemblers as you wish at a nominal price. The following S-C Macro Cross Assembler versions are now available, or soon will be:

Motorola:	6800/6801/6802	now	\$32.50
	6805	now	\$32.50
	6809	now	\$32.50
	68000	now	\$50.00
Intel:	8048	now	\$32.50
	8051	now	\$32.50
	8085	soon	\$32.50
Zilog:	Z-80	now	\$32.50
RCA:	1802/1805	now	\$32.50
Rockwell:	65C02	now	\$20.00
DEC:	PDP-11/LSI-11	now	\$50.00

The S-C Macro Assembler family is well known for its ease-of-use and powerful features. Thousands of users in over 30 countries and in every type of industry attest to its speed, dependability, and user-friendliness. There are 20 assembler directives to provide powerful macros, conditional assembly, and flexible data generation. INCLUDE and TARGET FILE capabilities allow source programs to be as large as your disk space. The integrated, co-resident source program editor provides global search and replace, move, and edit. The EDIT command has 15 sub-commands combined with global selection.

Each S-C Assembler diskette contains two complete ready-to-run assemblers: one is for execution in the mother-board RAM; the other executes in a 16K RAM Card. The HELLO program offers menu selection to load the version you desire. The disks may be copied using any standard Apple disk copy program, and copies of the assembler may be BSAVED on your working disks.

S-C Software Corporation has frequently been commended for outstanding support: competent telephone help, a monthly (by subscription, newsletter, continuing enhancements, and excellent upgrade policies.

S-C Software Corporation (214) 324-2050  
P.O. Box 280300, Dallas, Texas, 75228

## A PAUSE Directive.....Mike Laumer

Maybe your source code has outgrown even two disks and you need to know when to swap disks during assembly. Maybe you're using a single-sheet printer and need to change pages. Maybe you want to change typefaces on your letter-quality printer. Maybe you want to check the address of a routine or variable, without having to constantly watch the screen until it comes along. For whatever reason, you need to have the S-C Macro Assembler pause during assembly. Here is a new .US directive to let you do just that!

With this directive, you can insert a line like this anywhere in your code:

1300            .US SWAP SOURCE DISK

In each pass, when the assembler encounters this line it will pause, display "SWAP SOURCE DISK" in inverse text at the bottom of the screen, beep twice, and wait for a keypress. You can take whatever action you need to, and press any key to resume assembly.

The listing is for the Language Card version of the assembler. If you are using the main memory version, you don't need to worry about write-enabling and -protecting, so you can just delete lines 1220, 1230 and 1280.

The values for the .EQ statements in lines 1170-1180 depend on whether you are using the Main Memory or the Language Card assembler, and whether you have Version 1.0 or 1.1. Here's a table of the values for US.VCTR and SC.CMNT:

Main Memory	Language Card	Version
US.VCTR	\$100C	\$D00C
SC.CMNT	\$1FD8 \$1FCA	1.0 1.1

That's all there is to it! Now you don't have to constantly stare at the screen during those long assemblies. Now you can sit back and wait for your Apple to call you when it needs you.

```
1000 *-----  
1010 *     .US DIRECTIVE TO PAUSE DURING ASSEMBLY  
1020 *-----  
1030 *       SYNTAX: .US <phrase>  
1040 *       RESULT: Displays <phrase> in inverse text  
1050 *                      and waits for a keypress  
1060 *-----  
1070 *-----  
007B- 1080 CHR.PTR    .EQ $7B  
0200- 1090 WBUF       .EQ $200  
07D0- 1100 CORNER     .EQ $7D0  
C000- 1110 KEYBOARD   .EQ $C000  
C010- 1120 STROBE     .EQ $C010  
C080- 1130 PROTECT    .EQ $C080  
C083- 1140 ENABLE     .EQ $C083  
FBE2- 1150 BELL       .EQ $FBE2
```

## **D O W N L O A D I N G C U S T O M C H A R A C T E R S E T S**

One of the features 'hidden' in many printers available today is their ability to accept user-defined character sets. With the proper software, these **CUSTOM CHARACTERS** are 'downloaded' from your Apple II computer to the printer in a fraction of a second. Once the printer has 'learned' these new characters, they will be remembered until the printer is turned off.

After the downloading operation, you can use your printer with virtually any word processor. Just think of the possibilities! There's nothing like having your own **CUSTOM CHARACTERS** to help convey the message. And you still have access to those built-in fonts as well! Here's a quick look at some possible variations:

### **BUILT-IN**

10CPI: AaBbCcDdEeFfGgHhIiJjKk  
12CPI: AaBbCcDdEeFfGgHhIiJjKk  
17CPI: AaBbCcDdEeFfGgHhIiJjKk

### **CUSTOM**

AaBbCcDdEeFfGgHhIiJjKk  
AaBbCcDdEeFfGgHhIiJjKk  
AaBbCcDdEeFfGgHhIiJjKk

5CPI: AaBbCcDdEeFf  
6CPI: AaBbCcDdEeFf  
8CPI: AaBbCcDdEeFf

AaBbCcDdEeFf  
AaBbCcDdEeFf  
AaBbCcDdEeFf

And let's not forget Enhanced and Underlined printing as well...

AaBbCcDdEeFfGgHhIiJjKk  
AaBbCcDdEeFfGgHhIiJjKk

AaBbCcDdEeFfGgHhIiJjKk  
AaBbCcDdEeFfGgHhIiJjKk

The Font Downloader & Character Editor software package has been developed by RAK-WARE to help you unleash the power of your printer. The basic package includes the downloading software with 4 fonts to get you going. Also included is a character editor so that you can turn your creativity loose. Use it to generate unique character fonts, patterns, symbols and graphics. A detailed user's guide is provided on the program diskette.

### **SYSTEM REQUIREMENTS:**

- \* APPLE II, APPLE II Plus, APPLE //e or lookalike with 48K RAM
- \* 'DUMB' Parallel Printer Interface Board (like Apple's Parallel Printer Interface, TYMAC's PPC-100 or equivalent)

The Font Downloader & Editor package is only \$39.95 and is currently available for either the Apple Dot Matrix Printer or C.Itoh 8510AP (specify printer). Epson FX-80 and Okidata versions coming soon. Enclose payment with order to avoid \$3.00 handling & postage charge.

**R A K - W A R E**  
41 Ralph Road West Orange New Jersey 07052

Say You Saw It In **APPLE ASSEMBLY LINE!**

```

1160
D00C- 1170 US.VCTR :EQ $D00C
E124- 1180 SC.CMNT :EQ $E124
1190 *
1200 .OR $300
1210 *
0300- AD 83 C0 1220 LDA ENABLE WRITE ENABLE
0303- AD 83 C0 1230 LDA ENABLE RAM CARD
0306- A9 14 1240 LDA #PAUSE
0308- 8D OD DO 1250 STA US.VCTR+1 POINT .US VECTOR
030B- A9 03 1260 LDA /PAUSE
030D- 8D 0E DO 1270 STA US.VCTR+2 TO PAUSE ROUTINE
0310- AD 80 CO 1280 LDA PROTECT PROTECT CARD
0313- 60 1290 RTS
1300 *
0314- 20 E2 FB 1310 PAUSE JSR BELL BEEP
0317- A2 00 1320 LDX #0
0319- A4 7B 1330 LDY CHR.PTR CHAR POINTER
031B- B9 00 02 1340 .1 LDA WBUF,Y GET CHAR FROM CALL LINE
031E- F0 OB 1350 BEQ .2 END OF LINE?
0320- 29 3F 1360 AND #$3F NO, INVERT CHAR
0322- 9D DO 07 1370 STA CORNER,X AND PUT IT AT BOTTOM OF
0325- E8 1380 INX
0326- C8 1390 INY SCREEN
0327- E0 28 1400 CPX #40 LINE FULL?
0329- 90 F0 1410 BCC .1 NO, GET ANOTHER CHAR
1420
032B- 20 E2 FB 1430 :2 JSR BELL BEEP
032E- AD 00 C0 1440 :3 LDA KEYBOARD
0331- 10 FB 1450 BPL .3 WAIT FOR KEYPRESS
0333- 8D 10 C0 1460 STA STROBE
0336- 4C 24 E1 1470 JMP SC.CMNT RETURN TO ASSEMBLY
1480 *

```

## WHY YOU NEED THE INSPECTOR.

If you're serious about programming, you need to set all your utilities together in one place — *inside* your Apple. The Inspector comes on an Eprom that simply plugs into the D8 socket, or on a disk ready to merge with Integer Basic for automatic loading on boot. Either way, it stays at your fingertips, ready to call without disturbing your current program.

The Inspector puts you in total control of both memory and disks. You can search forward and backwards, edit, read nibbles, map disk space, dump the screen to a printer, examine every secret of your Apple. Use The Inspector to repair blown disks, undelete files, input "illegal" commands,

read and alter files, locate strings in memory or on disk. The uses are endless. The manual, alone, is an education. And it's always *there* when you need it.

You need the most powerful disk and memory utility available for your Apple. You need the Inspector.

See your local dealer, or order direct for just \$59.95. Mastercard and Visa holders order toll-free, 1-800-835-2246.



222 SO. RIVERSIDE PLAZA  
CHICAGO, IL 60606

312-648-1944

Apple is a registered trademark of Apple Computer, Inc.

## Some New Cards

1. Bob Stout just called from Houston to renew his subscription to AAL, and to tell me about a new toy he's getting. It seems that Legend Industries has a new kind of RAM card, containing 18K of static RAM, with battery backup.

16K of the memory on the card is mapped just like a language card, so it can be used in slot 0. The card also has a hardware write-protect switch, that you can throw to completely protect the memory. Once you have done that whatever you have stored in the card is there to stay.

The card can also be used in a higher slot for boot-up operation. The other 2K of memory is mapped at \$CN00 and \$C800, just like the ROM on a standard peripheral card. Think of the possibilities!

This new card from Legend is available with either NiCad or Lithium batteries. This gives you a choice between rechargeability or very long power-off life (about 2 years). The price is \$149.95.

2. Saturn Systems has introduced a card with 64K RAM and a 6502 on it. The CPU runs at 3.6 MHz, compared to Apple's roughly 1 MHz. Comes with a pre-boot disk to let you use this faster processor with Applesoft, Pascal, and Integer BASIC. Price is \$599. See their ad in the latest Softalk Magazine.

3. Analytical Engines, Inc. has one-upped the DTACK Grounded board. For only \$1550, you can plug in an 8 MHZ 68000 card with 128K RAM (expandable to 512K on the card!). You can upgrade to a 12.5 MHz chip if you really need it. DTACK is NOT grounded on this board, so you have access to the full 16-megabyte address space. The 16K ROM on the board contains monitor functions and diagnostics. You can replace the ROM with up to 64K of EPROM if you want. Software? The price includes a complete UCSD P-system (I think he said version 4.1) with Pascal, Basic, and Fortran compilers. You also get an Applesoft-compatible BASIC interpreter that runs entirely inside the 68000. CP/M-68 is optional, and Unix is supposed to be available soon. See their ad in the latest Nibble Magazine.

4. Lee Meador has designed a board with 64K RAM, 4K EPROM, and a 2MHz 6502 on it. This unique board does not talk directly to the Apple bus; instead, there are two parallel ports (I presume implemented with a 6522 chip). One 8-bit port talks to the Apple I/O bus, and the other is available to outside devices. Software runs on the board at 2MHz, and at the same time your Apple chips do their 1MHz processing. I can think of a lot of neat ways to use Lee's board, including as a printer buffer/controller, as a high-speed math processor, as a hard disk interface, and so on. If enough of you are interested, Lee will sell these for around \$500 each, along with some demonstration software.

## FADD -- Find ADDress references.....Brooke Boering

Recently I have been messing around with modifications to DOS. Since I didn't have the complete source code for it, I simply used the explanations in "Beneath Apple DOS". I did find that I also needed a utility to locate all references to certain addresses. FADD was the result, and it's mighty useful. It's much quicker than doing a complete disassembly.

FADD will locate all instructions within 64K of memory referring to a given address. It skips the \$C000-\$CFFF (I/O) pages and avoids missing memory by doing a double read test.

It is intended to be used by the serious assembly language programmer for debugging and analysis. It's faster than doing a disassembly, though not quite so informative.

FADD is originated at \$300 (what else?) and uses 8 zero page locations that are generally unused by programs except as scratch. You can alter both the origin point and zero page locations to suit your individual needs.

To use FADD:

- 1- BLOAD B.FADD
- 2- Get to Monitor
- 3- 'Fat finger' your address into 6-7 in HI-LO order.
- 4- Execute with a '300G'

NOTE: Use the spacebar to pause/release listing.

## INTRODUCING WATSON™

**Teamed up inside  
your Apple, Watson  
adds new features  
that give you complete  
access to everything you ever  
wanted to know about memory  
and disks. Recover blown disks,  
fix catalog entries, display and delete  
control characters, repair bad data files even  
on disks with non-normal DOS. Search for ward and  
backwards in memory, edit in HEX, ASCII, NEGATIVE ASCII  
and LOWER CASE. Scan disks for ward and backwards, follow files  
for ward and backwards in track/sector list on either 13- or 16-sector  
disks. Lockout sectors on Track Bit Map, reconstruct VTOC, find and display all  
Track/Sector Lists, display map of Sectors used on disk, read RIBbles track-by-track.  
Compatible with ASCII displayed, full inverse and blanking characters, verify and compare disks and display  
differences, write directly to disks. After DOS to display control characters in inverse, and dump the  
screen to a printer via CTL-Z, even from within BASIC. There's more but we're running out of space.  
Oh well, you get the idea.**

## NOW THE INSPECTOR® HAS AN ASSISTANT



Eeprom or disk versions are always at  
your fingertips. Watson (requires The  
Inspector), \$49.95. The Inspector,  
\$59.95. At your local dealer or direct.  
MasterCard and Visa holders order  
toll-free or return the coupon.

**1-800-835-2246**



Send me  
 The Inspector @ \$59.95  
 Watson @ \$49.95  
Check or money order enclosed.  
System description:  
Apple II  Apple II+  Integer Card  16K Ram Card   
name \_\_\_\_\_  
address \_\_\_\_\_  
\_\_\_\_\_  
name tag \_\_\_\_\_

© 1982 Omega Microware, Inc.  
Apple is a registered trademark of Apple Computer, Inc.

```

1000 *****
1010 *
1020 * F A D D
1030 *
1040 * ( FIND ADDRESS REFERENCES )
1050 *
1060 *
1070 * A PUBLIC DOMAIN UTILITY
1080 *
1090 * BY.. BROOKE W BOERING
1100 *
1110 *****
1350 *
1360 * TO USE:
1370 * 1- BLOAD FADD.OBJ
1380 * 2- GET TO MONITOR
1390 * 3- 'FAT FINGER' YOUR ADDRESS
1400 * INTO 6-7 IN HI-LQ ORDER.
1410 * NOTE -----> <-----
1420 * 4- EXECUTE WITH A '300G'
1430 *
1440 *
1450 *
1460 *
1470 * -----
1480 * E Q U A T E S
1490 TARGHI .EQ $6
1500 TARGLO .EQ $7
1510 * NOTE: ABOVE REVERSES NORMAL LO/HI-BYTE
1520 * ORDER FOR EASIER KEYIN FROM MONITOR
0008- 1530 WHER .EQ $8
0008- 1540 WHERLO .EQ $8
0009- 1550 WHERHI .EQ $9
1560 *
1570 LENGTH .EQ $2F
1580 PCL .EQ $3A
1590 PCH .EQ $3B
1600 COLOR .EQ $30
1610 *
1620 INSDS2 .EQ $F88E
1630 INSTDSP .EQ $F8D0
1640 PCADJ3 .EQ $F956
1650 CROUT .EQ $FD8E
1660 *
1670 .OR $300
1680 * .TF B.FADD
1690 *
1700 START
1710 *
0300- A2 00 1720 LDX #0
0302- 86 08 1730 STX WHERLO START AT BEGINNING
0304- 86 09 1740 STX WHERHI OF MEMORY
1750 *
1760 *-- CHECK FOR DIRECT REFERENCE
1770 *
0306- A0 00 1780 LDY #0
0308- B1 08 1790 LDA (WHER),Y GET WHERAT-LO
030A- 85 30 1800 STA COLOR SAVE TEMP
030C- B1 08 1810 LDA (WHER),Y GET IT AGAIN
030E- C5 30 1820 CMP COLOR STILL THE SAME?
0310- D0 5D 1830 BNE .8 NO, SKIP IT, NO MEMORY HERE
1840 * (FALL THROUGH IF MEMORY AT THIS ADDRESS)
1850 *
0312- C5 07 1860 CMP TARGLO ? TARGET-LO ?
0314- D0 20 1870 BNE .3 NO, GO AHEAD
0316- C8 00 1880INY
0317- B1 08 1890 LDA (WHER),Y GET WHERAT-HI
0319- C5 06 1900 CMP TARGHI ? TARGET-HI ?
031B- D0 19 1910 BNE .3 NO, GO AHEAD
1920 * (FALL THROUGH IF 2-BYTE MATCH ON TARGET)
1930 *
1940 *-- APPARENT MATCH:
1950 * MAKE SURE IT'S A 3-BYTE INSTRUCTION
1960 *
031D- A4 09 1970 LDY WHERHI GET ADDRESS OF MATCH
031F- A6 08 1980 LDX WHERLO
0321- D0 01 1990 BNE .24
0323- 88 2000 DEY POINT TO INSTRUCTION BYTE

```

0324- 6A	00	2010 .24	
0325- 86	3A	2020 DEX	
0327- 84	3B	2030 STX PCL	AND SET PROGRAM COUNTER
		2040 STY PCH	
		2050	
0329- A2	00	2060 LDX #0	
032B- A1	3A	2070 LDA (PCL,X)	GET OPCODE
032D- 20	8E	2080 JSR INSDS2	USE MONITOR DISASSEMBLER ROUTINE
0330- A5	2F	2090 LDA LENGTH	
0332- C9	02	2100 CMP #2	3-BYTE INSTRUCTION?
0334- F0	26	2110 BEQ .6	OK; GO AHEAD TO DISPLAY
		2120 * (FALL THROUGH WHEN NOT A 3-BYTE INSTR)	
		2130	
		2140 *-- CHECK FOR RELATIVE BRANCH	
		2150 .3	
0336- A0	00	2160 LDY #0	
0338- B1	08	2170 LDA (WHER),Y	GET INSTRUCTION BYTE
033A- 29	1F	2180 AND #1F	ISOLATE SIGNIFICANT BITS
033C- C9	10	2190 CMP #\$10	A BRANCH INSTRUCTION?
033E- D0	2F	2200 BNE .8	DEFINITELY NOT
		2210 * (FALL THROUGH WHEN A BRANCH INSTRUCTION)	
		2220	
		2230 *-- TEST IF BRANCHING TO TARGET	
		2240 * NOTE: USING MONITOR TECHNIQUE	
		2250 .4	
0340- A6	08	2260 LDX WHERLO	PRESET FOR PCADJ3
0342- A4	09	2270 LDY WHERHI	
0344- 86	3A	2280 STX PCL	SET PC TO OPCODE BYTE
0346- 84	3B	2290 STY PCH	
0348- A0	01	2300 LDY #1	
034A- B1	08	2310 LDA (WHER),Y	GET OFFSET BYTE
034C- 20	56	2320 JSR PCADJ3	LEAVES EFFECTIVE ADDRESS-1
		2330 * IN Y AND A	
034F- AA		2340 TAX	
0350- E8		2350 INX	
0351- D0	01	2360 BNE .43	
0353- C8		2370INY	
		2380 .43	
		2390 * NOW 'BRANCH TO' ADDRESS IS IN Y AND X	
0354- E4	07	2400 CPX TARGLO	
0356- D0	17	2410 BNE .8	
0358- C4	06	2420 CPY TARGHI	
035A- DO	13	2430 BNE .8	
		2440 * (FALL THROUGH ON MATCH)	
		2450	
		2460 *-- DISPLAY MATCHED INSTRUCTION	
		2470 .6	
035C- 20	D0	2480 JSR INSTDSP	<= MONITOR ROUTINE
		2490	
		2500 *-- ALLOW KEYED PAUSE/RELEASE	
		2510 .7	
035F- 2C	00	2520 BIT \$C000	KEY DOWN?
0362- 10	0B	2530 BPL .8	NO, GO AHEAD
0364- 2C	10	2540 BIT \$C010	YES, CLEAR STROBE
		2550	
0367- 2C	00	2560 .77	
036A- 10	FB	2570 BIT \$C000	RELEASED?
036C- 2C	10	2580 BPL .77	NO, LOOP TIL SO
		2590 BIT \$C010	YES, CLEAR STROBE
		2600	
		2610 *-- POST DISPLAY (OR NO MATCH)	
		2620 .8	
036F- E6	08	2630 INC WHERLO	KICK ADDRESS
0371- D0	93	2640 BNE .1	LOOP 255 OF 256
0373- E6	09	2650 INC WHERHI	KICK ADDR PAGE#
0375- F0	0C	2660 BEQ .9	EXIT AT 65536 OVFL0
		2670	
		2680 *-- AT NEW PAGE !!	
0377- A5	09	2690 LDA WHERHI	
0379- C9	C0	2700 CMP #\$C0	AT THE I/O PORTS ?
037B- D0	89	2710 BNE .1	NO, LOOP BACK
037D- A9	D0	2720 LDA #\$D0	YES, SKIP 'EM
037F- 85	09	2730 STA WHERHI	: (AVOID PROBLEMS)
0381- D0	83	2740 BNE .1	LOOP BACK
		2750	
		2760 .9	
0383- 4C	8E	2770 JMP CROUT	RETURN THROUGH CROUT

## Generating Parity.....Bob Sander-Cederlof

When large amounts of data are being moved around it is easy to garble some. When you transmit characters over the telephone, or read them from a tape or disk, you want some kind of assurance that the message does not get modified by the medium.

Lots of schemes have been invented to prevent, detect, and even correct transmission errors: checksums, parity, cyclic redundancy codes, and more.

Checksums are used inside the Apple all the time. If you ever used cassette tapes with your Apple, you were re-assured to know that each program was recorded with a checksum. DOS 3.3 adds a checksum to the end of every sector on the disk. The checksum is re-computed when you read a tape or disk sector; if the result is different, at least one bit in the data is wrong.

Most of the checksums I have seen are of the exclusive-or type. All the bytes in the data record are EORed together, and the result is written at the end of the record. When the data is read, the in-coming bytes are again EORed together, and finally EORed with the checksum itself. If the final result is non-zero, an error occurred.

Checksums in the Apple are usually one byte wide. However, for more security, you could form a wider checksum. Or you could ADD the bytes together and store a two byte sum. Or store the complement of the sum, so that adding all the bytes plus the complement will give a zero result if there are no errors. [Checksums may check out OK even though errors occur, if the errors are sneaky enough to cancel each other out.]

Parity is really a kind of checksum, but only one bit wide. A series of bits is EORed together, and the single-bit result is the parity value. In an ASCII character there is provision for the leading bit position to be used for storing a parity bit. An eight-bit byte holds seven data bits plus a parity bit.

There are two kinds of parity in use: even and odd. Even parity makes the total number of 1-bits in the stream of bits even; odd parity makes the total number of 1-bits odd. Both even and odd are in use today in various kinds of equipment. Many terminals and serial communication boards allow you to select even, odd, or no parity. Looking at the ASCII code for a couple of letters, each could be transmitted in four ways:

Letter "M" 0 1 0 0 1 1 0 1 -- No parity, 8th bit always 0  
              1 1 0 0 1 1 0 1 -- No parity, 8th bit always 1  
              0 1 0 0 1 1 0 1 -- Even parity  
              1 1 0 0 1 1 0 1 -- Odd parity

Letter "Q" 0 1 0 1 0 0 0 1 -- No parity, 8th bit always 0  
              1 1 0 1 0 0 0 1 -- No parity, 8th bit always 1  
              1 1 0 1 0 0 0 1 -- Even parity  
              0 1 0 1 0 0 0 1 -- Odd parity

Sometimes I have needed a quick way to generate or verify a parity bit with software. These matters are usually handled in hardware, but not always.

In the 6502, it is a very simple matter to rotate a byte around and count the number of one bits present. Then the parity bit can be merged with the byte, or compared with what is already there.

The following subroutine (PARITY) computes the parity bit and merges it with the data byte. Call PARITY with the character to be merged in the A-register. Only the seven data bits will be counted. As written, the subroutine computes an odd parity bit. You can change line 1030 to "LDX #0" to compute even parity.

```
1000 *-----  
1010 * Compute and merge parity bit  
1020 *-----  
1030 PARITY LDX #1      (#0 FOR EVEN PARITY)  
1040     ASL      SHIFT PARITY POSITION OUT  
1050     PHA      SAVE SHIFTED CHARACTER  
1060 .1    BPL .2      IF NEXT BIT = 0, DON'T COUNT  
1070     INX      IF NEXT BIT = 1, COUNT IT  
1080 .2    ASL      SHIFT IN NEXT BIT  
1090     BNE .1      IF ANY REMAINING BITS = 1  
1100     TXA      GET COUNT OF 1-BITS  
1110     LSR      EVEN/ODD BIT OF COUNT INTO CARRY  
1120     PLA      ORIGINAL CHAR BUT SHIFTED  
1130     ROR      SHIFT PARITY BIT INTO BIT 8  
1140     RTS
```

I wrote a little program to drive the PARITY subroutine, using all possible values from 0 through 127, and print out the results:

```
1150 *-----  
1160 PRHEX .EQ $FDDA MONITOR PRINT (A) IN HEX  
1170 COUT .EQ $FDED MONITOR PRINT CHAR IN (A)  
1180 *-----  
1190 DEMO  LDA #0      FOR CHAR = $00 TO $7F  
1200     STA CHAR  
1210 .1    JSR PARITY CALL THE PARITY SUBROUTINE  
1220     JSR PRHEX PRINT THE CHARACTER.  
1230     INC CHAR NEXT CHAR  
1240     LDA CHAR SEE IF TIME FOR A NEW LINT  
1250     AND #$07  
1260     BEQ .2      YES  
1270     LDA #$A0     <SPACE>  
1280     BNE .3      ...ALWAYS  
1290 .2    LDA #$8D     <RETURN>  
1300 .3    JSR COUT   PRINT SPACE OR RETURN  
1310     LDA CHAR  
1320     BPL .1      STILL LESS THAN $80  
1330     RTS      DEMO FINISHED
```

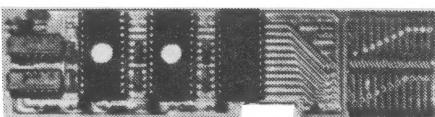
When I set it up for odd parity, here is part of the table printed out by DEMO:

```
80 01 02 83 04 85 86 07  
08 89 8A 0B 8C 0D 0E 8F  
10 91 92 13 94 15 16 97  
.  
.  
F8 79 7A FB 7C FD FE 7F
```

Now, how about a subroutine to check parity? Here is a version that checks an 8-bit value for odd parity. Simply change line 1420 to "LDX #0" to check for even parity instead. The subroutine returns with CARRY CLEAR for good parity, or CARRY SET for bad parity.

```
1400 *-----  
1410 CHECK.PARITY  
1420 LDX #1      (OR #0 FOR EVEN PARITY)  
1430 PHA        SAVE ORIGINAL CHAR  
1440 .1 ASL      SHIFT NEXT BIT INTO CARRY  
1450 BEQ .2      NO REMAINING 1-BITS  
1460 BCC .1      LEADING BIT NOT 1-BIT  
1470 INX        COUNT THE 1-BIT  
1480 BCS .1      ...ALWAYS  
1490 .2 BCC .3    LATEST SHIFTED BIT WAS 0  
1500 INX        LATEST SHIFTED BIT WAS 1  
1510 .3 TXA      BIT COUNT  
1520 LSR        SHIFT EVEN/ODD BIT INTO CARRY  
1530 PLA      RESTORE ORIGINAL CHARACTER  
1540 RTS
```

# EXPAND YOUR APPLE'S CAPABILITY



## TIRED OF TURNING OFF YOUR APPLE TO ESCAPE FROM A PROGRAM WHICH TAKES CONTROL OF YOUR COMPUTER?

If you said yes, then the CMW PROM Switch (PS-1) is for you. The PS-1 ROM expansion board plugs into a motherboard ROM socket and allows you to switch between Apple ROMs and commercial or self programmed EPROMs. Used in socket S8, you can switch between the Autostart Monitor, the older Apple II Monitor, or a customized monitor to easily set your own RESET vectors. Used in other sockets, SDO to SF0, even Apple II Plus users can use programs like Omega Microware's "Inspector" PROM, or Apple's "Programmer's Aid". The PS-1 can use up to three Apple ROMs, 2716 5-volt EPROMs, or any combination. Up to 4 PS-1s can be installed in your computer at one time giving you the capability to switch-select 8 additional 2K ROM/EPROMs such as printer drivers, utilities, etc. ROM/EPROMs not in use are turned off, minimizing power supply loading. Customers appreciate the convenience of having their favorite utilities on line at the flick of a conveniently located toggle switch. Order from CMW direct; mention this Ad for a 15% discount (offer good for 30 days from publication date). List Price ..... \$49.95

## OTHER PINE CMW PRODUCTS

\* SUPER CATALOG ROM - For use with PROM Switch. Load, Verify, Run, Delete, Transfer, Lock, and Unlock files with two key stroke operation. Runs in socket E8 - special versions for other sockets available upon request. Model CR-1 ..... \$14.95

\* The DISK SWITCH - Gives complete control of the write protect switch in your disk drive. Write on the backs of diskettes without cutting a notch or disable any write enable regardless of notch. Model DSK-1 ..... \$11.95

\* The PROMETTE - Allows you use EPROMs in any ROM socket directly. Model PC-1 ..... \$4.95

\* The DOS SWITCH - The original one. Allows convenient direct boot of either DOS 3.2 or 3.3. Model DS-1 ..... \$19.95

---

Add \$2.00 - shipping. OR add 5.5% sales tax, VISA, MC, Check, COD (add \$1.40). Write for our flyer on CMW products.

APPLE II is a registered trademark of Apple Computer, Inc.



COMPUTER MICRO WORKS INC

P.O. Box 33651 Dayton, Ohio 45433

(305) 777-0268 (FL sales office)

# Apple Peripherals Are All We Make

That's Why We're So Good At It!

## The TIMEMASTER

Finally, a clock that does it ALL!



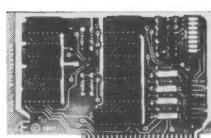
- Designed in 1983 using I.C. technologies that simply did not exist when most other Apple clocks were designed.
- Just plug it in and your programs can read the year, month, date, day, and time — down to 1 millisecond!
- Powerful 2K ROM driver — No clock could be easier to use.
- Full emulation of most other clocks, including Mountain Hardware's Appleclock (but you'll like the TIMEMASTER mode better).
- Compatible with all of Apple's languages, CP/M and PASCAL software on disk.
- Eight software controlled interrupts so you can execute two programs at the same time.
- On board timer lets you time any interval up to 48 days long down to the nearest millisecond.

The TIMEMASTER includes a disk with some really fantastic time oriented programs (over 25) plus a DOS dater so it will automatically add the date when disk files are created or modified. This disk is over a \$200.00 value alone — we give the software others sell. All software packages for business, data base management and communications are made to read the TIMEMASTER.

If you want the most powerful and the easiest to use clock for your Apple, you want a TIMEMASTER.

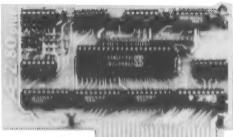
**PRICE \$129.00**

## Super Music Synthesizer



- Complete 16 voice music synthesizer on one card. Just plug it into your Apple, connect the audio cable (supplied) to your stereo, boot the disk supplied and you are ready to input and play songs.
- It's easy to program music with our compose software. You will start right away at inputting your favorite songs. The Hi-Res screen shows what you have entered in standard sheet music format.
- We give you lots of software. In addition to Compose and Play programs, the disk is filled with songs ready to play.
- Easy to program in Basic to generate complex sound effects.
- Four white noise generators which are great for sound effects.
- Plays music in true stereo as well as true discrete quadraphonic.
- Full envelope control.
- Will play songs written for ALF synthesizer (ALF software will not take advantage of all the features of this board. Their software sounds the same in our synthesizer.)
- Automatic shutdown on power-up or if reset is pushed.
- Many many more features.

**PRICE \$159.00**



- TOTALLY compatible with ALL C P/M software.
- Executes the full Z-80 and 8080 instruction set.
- Fully compatible with microsoft disks (no pre-boot required).

## Z-80 PLUS!

- An on-card PROM eliminates many I.C.'s for a cooler, less power consuming board. (We use the Z-80A at a fast 3.58 MHZ)
- Does EVERYTHING the other Z-80 boards do, plus Z-80 interrupts.
- All new 1983 design incorporates the latest in I.C. technologies.
- Complete documentation included. (User must furnish software)

The Z-80 PLUS turns your Apple into a CP/M based computer. This means you can access the largest body of software in existence. Two computers in one and the advantages of both, all at an unbelievably low price.

**PRICE \$139.00**

## Analog to Digital Converter

- 8 Channels
- 8 Bit Resolution
- On Board Memory
- Fast Conversion (.078 ms per channel)
- Eliminates the Need to Wait for A/D Conversion (just PEEK at data)
- A/D Process Totally Transparent to Apple (looks like memory)

The analog to digital conversion takes place on a continuous, channel sequencing basis. Data is automatically transferred to on board memory at the end of each conversion. No A/D converter could be easier to use.

Our A/D board comes standard with 0, 10V full scale inputs. These inputs can be changed by the user to 0, -10V, or -5V, +5V or other ranges as needed.

Information on temperature sensors is given in manual. The user connector has +12 and -12 volts on it so you can power your sensors.

Accuracy      0.3%      Input Resistance      20K Ohms Typ

A few applications may include monitoring and control of ● flow temperature ● humidity ● wind speed ● wind direction ● light intensity ● pressure ● RPM ● storage oscilloscope ● soil moisture and many more.

**PRICE \$129.00**

## Digital Input/Output Board

- Provides 8 buffered outputs to a standard 16 pin socket for standard dip ribbon cable connection
- Power-up reset assures that all outputs are off when your Apple is turned on.
- Features 8 inputs that can be driven from TTL logic or any 5 volt source.

- Your inputs can be anything from high speed logic to simple switches.
- Very simple to program, just PEEK at the data.
- Now, on one card, you can have 8 digital outputs and 8 digital inputs each with its own connector. The super input/output board is your best choice for any control application.

**PRICE \$62.00**

Our boards are far superior to most of the consumer electronics made today. All I.C.'s are in high quality sockets with mil-spec. components used throughout. P.C. boards are glass-epoxy with gold contacts. Made in America to be the best in the world. All products work in APPLE IIe, II and II+

Applied Engineering's products are fully tested with complete documentation and available for immediate delivery. All products are guaranteed with a no hassle two year warranty.

All Orders Shipped Same Day  
Texas Residents Add 5% Sales Tax  
Add \$10.00 If Outside U.S.A.

Send Check or Money Order To:  
**APPLIED ENGINEERING**  
P.O. Box 470301  
Dallas, TX 75247

Call (214) 492-2027  
7am to 11pm 7 days a week  
MasterCard & Visa Welcome

I was writing an ampersand file-handling routine, using the File Manager in DOS as described in chapter 6 of Beneath Apple DOS. I wanted my Applesoft program to be able to set ONERR and catch errors in files (wrong name, too short, etc.) But I also wanted the error messages to come out in immediate mode or with no ONERR set. Since I was doing my own file-handling, I was going to have to provide my own error outputs. Originally I tried this:

```
ERROR LDY #$0A      error code offset
       LDA ($04),Y    $04 -> FM parmlist
       JMP $A6D2      jump into DOS error handler
```

This worked OK when used in code that was called from an Applesoft program, but when I called it in immediate mode (from the "]") I would always get "ROGRAM TOO LARGE" when an error occurred.

You might guess that I have found a solution. The problem is caused when we jump into DOS at \$A6D2 with the IO hooks still pointing into DOS. The routine starting at \$A6D2 saves the error code in a temporary location at \$AA5C and calls \$A702 to print a "<return><beep><return>". Since we entered illegally that output goes to DOS at \$9EBD, then via a JSR to \$9ED1 where the accumulator is saved in a temporary location -- \$AA5C! This leaves that last <return> in \$AA5C.

When control returns to the error handler DOS then tries to look up error message number 141 (\$8D) in the 16-entry table of offsets starting at \$AA3F. This loads the offset from location \$AAC, which happens to contain the high-order byte of the address of the OPEN command handler (\$AB22)! This leaves the error message printer with an offset of \$AB into the messages at \$A971. And that is what produces "ROGRAM TOO LARGE". Look at the routines at \$A6D2 and \$A702 for more detail. \$A702 is meant to be called with the error code in the X register.

Now here's a method to have the error handled correctly:

```
OUT.HOOK .EQ $36
HARD.COUT .EQ $FDF0
```

```
ERROR LDA #HARD.COUT point hook out of DOS
       STA OUT.HOOK
       LDA /HARD.COUT
       STA OUT.HOOK+1 DOS will fix it back
       LDY #$0A      index to error code
       LDA ($04),Y    $04 -> FM parmlist
       JMP $A6D2      do it ...
```

Apple Assembly Line is published monthly by S-C SOFTWARE CORPORATION, P.O. Box 280300, Dallas, Texas 75228. Phone (214) 324-2050. Subscription rate is \$15 per year in the USA, sent Bulk Mail; add \$3 for First Class postage in USA, Canada, and Mexico; add \$13 postage for other countries. Back issues are available for \$1.50 each (other countries add \$1 per back issue for postage).

All material herein is copyrighted by S-C SOFTWARE CORPORATION, all rights reserved. (Apple is a registered trademark of Apple Computer, Inc.)